

Hands-On Activities with Programmable Logic Controllers (PLCs)

SAME-TEC 2008 Austin, TX
Mechatronics Workshop Thurs 7-31-08

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Demand for PLC Savvy Technicians

- There is a demand for technicians with PLC experience
- Demand in many different sectors
 - large and small companies doing manufacturing, distribution, power generation... anything with automated processes
 - Does not 'marry' curriculum to one sector – serves many sectors
 - Demand increase... enrollment increase

PLC Skill Set

- Basic PLC skills in demand to enable effective troubleshooting and system startup
 - PLC connections
 - Hardware/ Software diagnostics
 - Basic PLC Programming Skills (ladder logic, PLC notations, download/upload programs)
- Hands-on learning activities teach these skills best.

More Hands On Learning with PLCs!

- Many Electrical Technology (ELT) programs are looking for more hands on learning – HOW?
- Building lab activities can be very time consuming
 - Acquire materials, software, create teaching materials
- Buying lab activities can be expensive and large
 - Comes complete with all hardware, software, teaching materials, but high budget and space requirements

The simple approach

- I built simple PLC lab benches.
- I am sharing the success of my efforts (so far).
- The benches have been used over the last year in:
 - Credit courses (ELT216: Automated Systems)
 - Non-credit PLC training for local company technicians

Poll the Audience

- Experience Level with PLCs
 - Lots
 - Some
 - None
- Interest
 - Want to include hands-on activities with PLCs in courses
 - Want to see what other schools are doing, alternatives
 - Curiosity

PLC Lab Bench Hardware

Hardware

- Small PLC
 - I used A-B Micrologix series
 - A few I/O points (approx. 10-14), on the CPU block
- Switches, Indicating Lights (oiltight \$\$)
- Additional Sensors & Actuators
 - IR beam break, fan motor, pump motor, analog input device...
- Terminal Block
- Accessories
 - DIN Rail, wire trough, plywood, wire labels, fuse, switch...
- Complete list of materials included with this presentation.
- Approximate cost of \$1200 per PLC lab bench
 - Approximately \$600 for the PLC
 - without alternate acquisition of select materials

Students Build the PLC Bench

Students wire all components

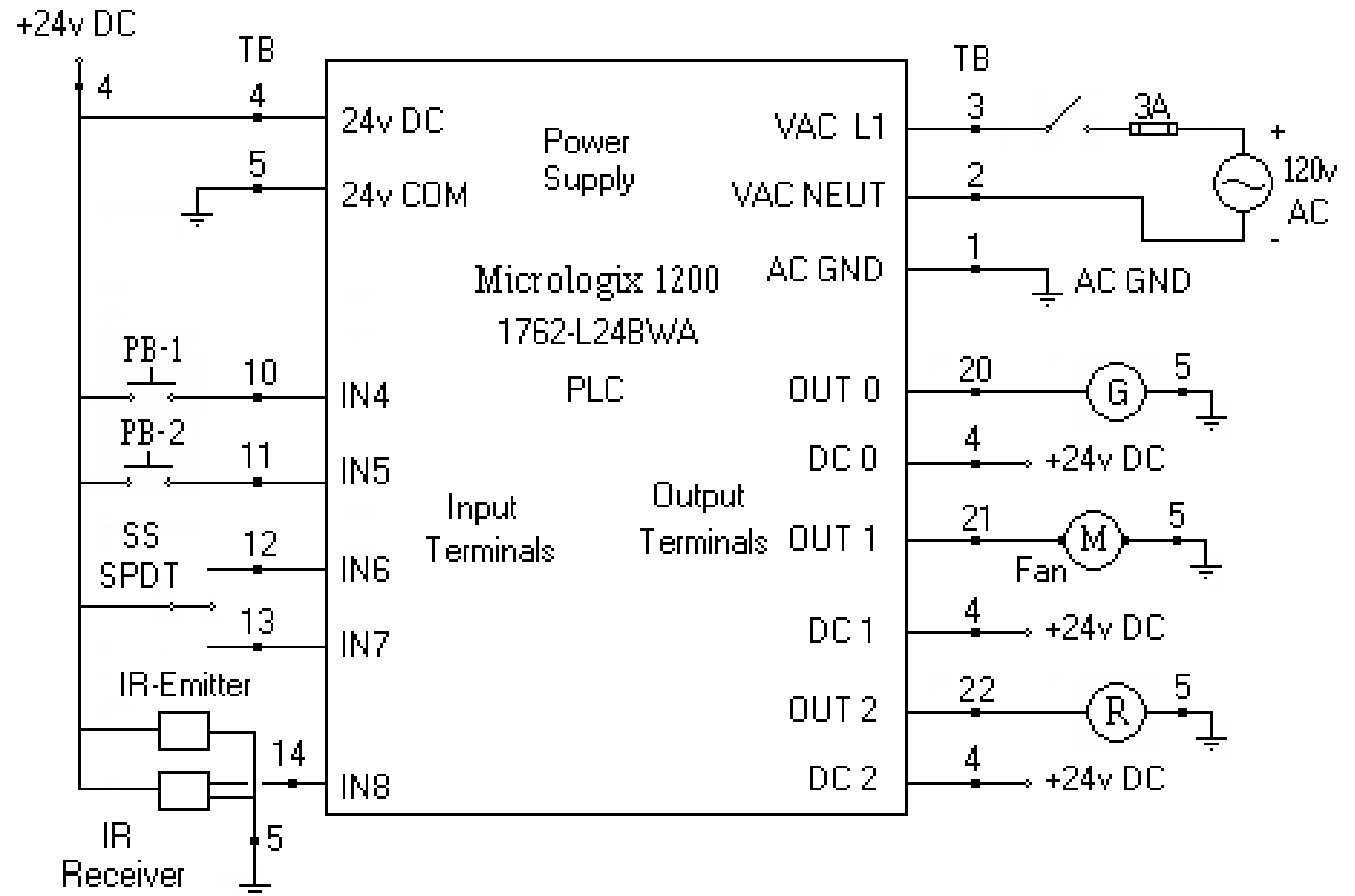
- Worthy exercise for traditional students
 - may or may not have experience wiring real devices
 - Gives the feel for remote location of components vs. symbols in ladder logic
- Teaches good wiring habits, such as labeling wires on both ends
- Much easier and less time consuming than instructor building benches

My PLC Bench Wiring Diagram

Terminal Block (TB)
Power Supply Points

- 1 = AC GND
- 2 = AC Neutral
- 3 = 120v Line In
- 4 = +24v DC
- 5 = 24v GND

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PLC Lab Bench Software

- Ladder Logic Software
 - License arrangements vary
 - Software shows PLC actions on screen

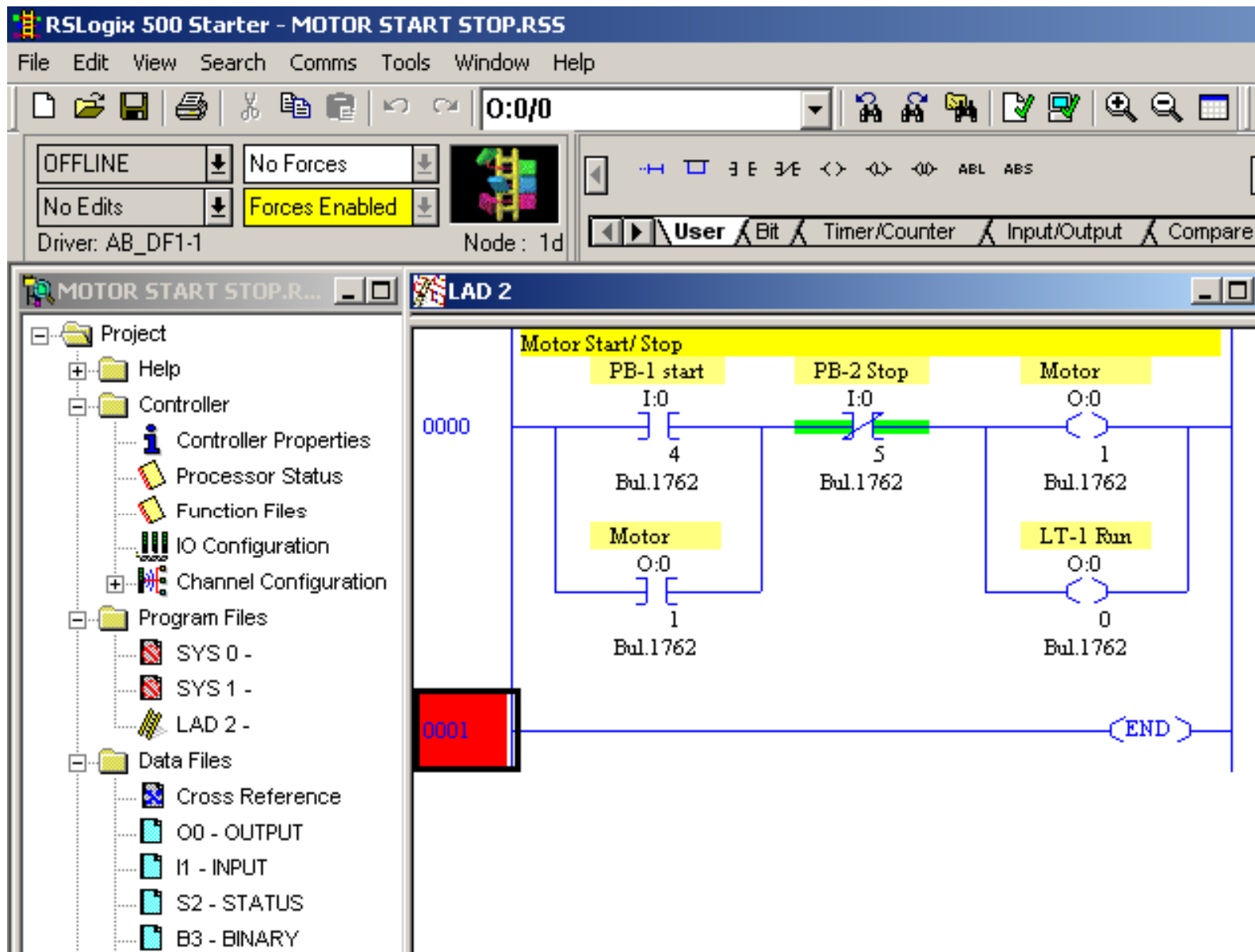
PLC Lab Bench Teaching Materials

- Lecture notes included with this presentation
 - Vocabulary, memory types, I/O internal circuitry
- Lab Procedure included with this presentation
- Text used with PLC Activity: Modern Control Technology; Killian

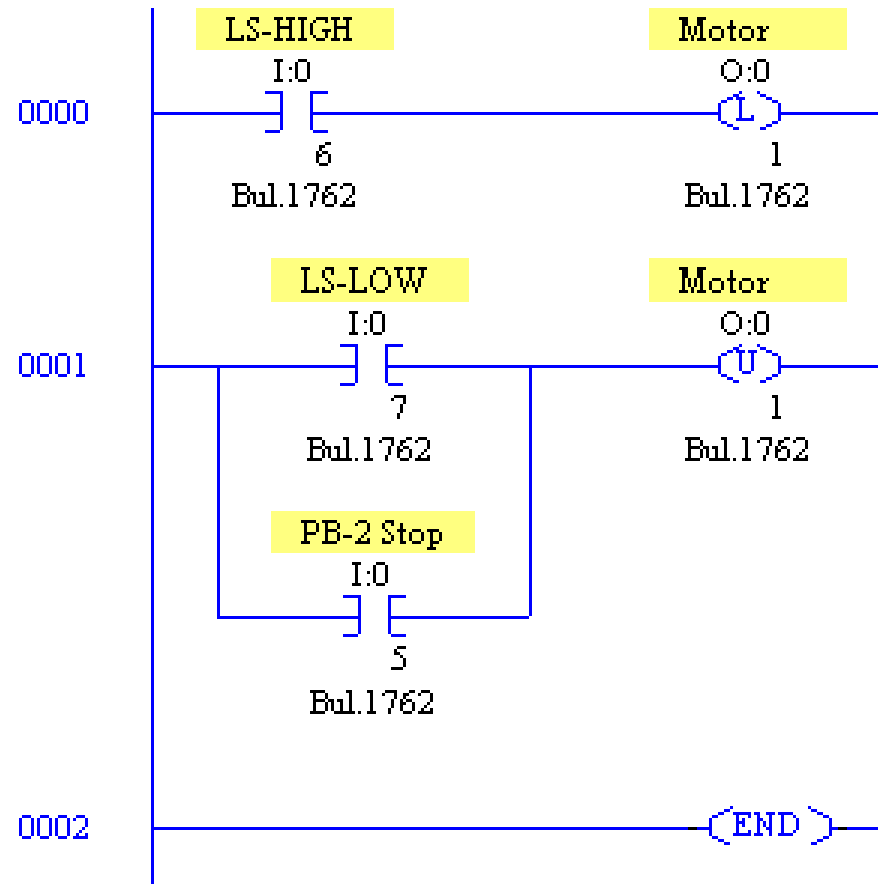
Lab Bench Activity Examples

- Motor Start/ Stop (basic):
 - Contacts, seal-in circuit, inverse logic
- Sump Pump (basic)
 - Hysteresis, interconnected contacts (high-low switch)
- Batch Mixer (intermediate)
 - Counter, timer, memory locations

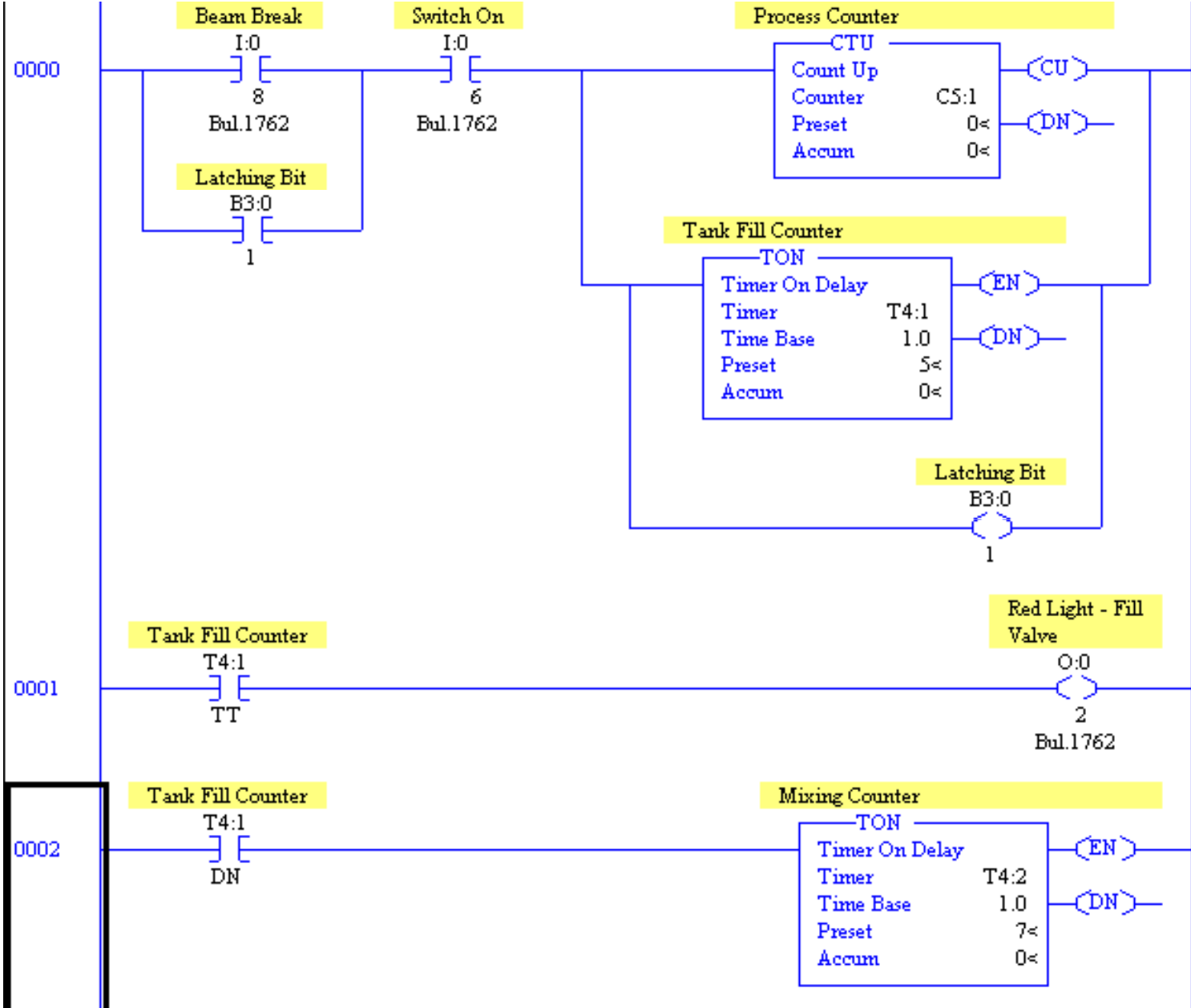
Example: Motor Start/ Stop



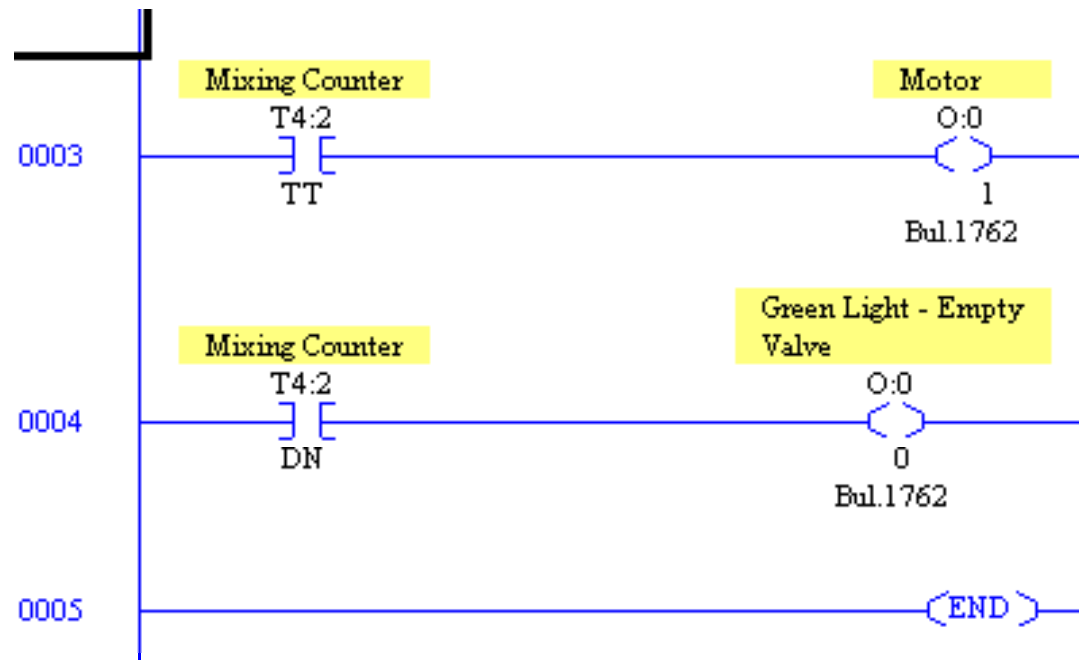
Example: Sump Pump



Example: Batch Mixing (counter & timer)



Example: Batch Mixing (counter & timer)



Feedback

- I hope sharing my idea with you was worthwhile
- If you use this idea, let me know (especially how I can make improvements)
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